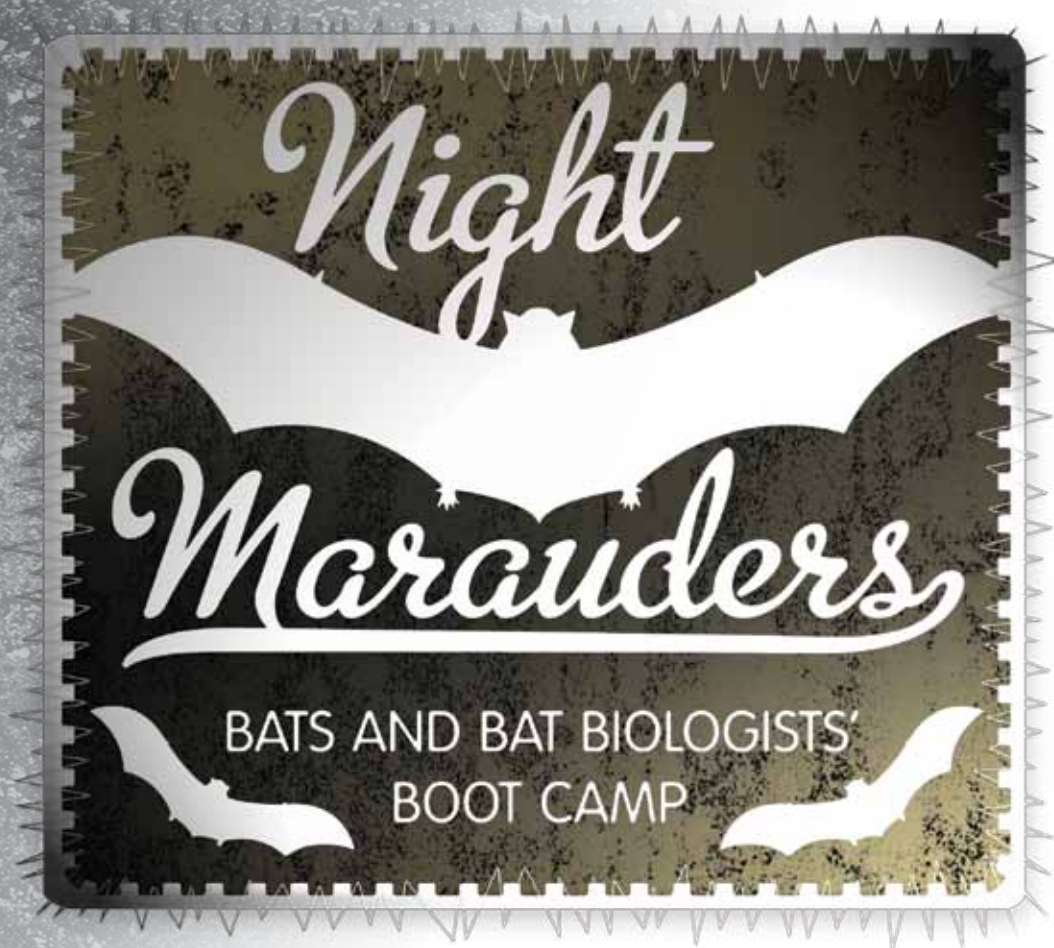


Researcher Russ Benedict examines a bat caught during a four-year study that will unlock clues to an endangered species' summer habitat. Benedict and DNR Zoologist Daryl Howell must wait until female bats give birth in late June or early July to locate, capture and tag bats—a labor-intensive project.

The study began in 2005, when the team surveyed 50 barns and 30 concrete bridges in south central Iowa for signs of occupation—primarily bat scat or evening flights—to determine if the areas are important roost sites.







Visions of haunted houses and vampires.  
Shivers of trepidation.  
It's those feelings that have led many bat species  
to the brink of extinction.

BY KAREN GRIMES PHOTOS BY CLAY SMITH

#### A NIGHT OF NETTING

**A**t best, people respond to bats with indifference, often with fear or disgust. A few respond with active malice. Not many recognize that bats contribute greatly to people's comfort level and their food supply. And not many people set out to save bats by trapping them on a midsummer's night.

**THE NIGHT OF JULY 16, 2007**, is a typical, hot summer night for bat netting. The location is the Des Moines River valley near Selma in Van Buren County. Remnants of oak savannahs dot the hilly uplands and banks of the river. Cornfields fill the broad river valley. Dusty cars line the gravel road as team members spill out and walk along a short lane. The team's target is a dilapidated gray barn, more holes and rust than roof and siding.

At 6:15 p.m., the eastern sky turns that dark purple, periwinkle blue that precedes a summer thunderstorm. To

the west, a hazy aqua sky hints at a normal summer night.

Good. They can trap bats tonight.

Crawling over a gate, the air is permeated with the pungent aroma that only cattle leave behind.

The barn is anything but impressive. Its framework remains, but most of the upper siding is gone. The team's mission is to close off all the holes in the barn. Higher up, they will cover the holes with tarps to keep the bats in. Lower down, they will use nets to catch the bats as they try to leave the barn to forage or enter the barn to rest.

The team's target is a small, harmless mammal that has more in common with people than birds. Covered in soft, glossy fur, she bears her young alive and nurses them. Warm-blooded, the Indiana bat weighs less than 8 grams or one-third of an ounce—the weight of three pennies.

At 3.5 inches long, it can easily fit in the palm of a hand, although it has a much bigger presence with wings





unfurled to a full 10 inches.

Team leaders are Russ Benedict, long-time bat enthusiast and Central College professor, and Daryl Howell, DNR zoologist. This is the third year of the quest for the summer homes of the Indiana Bat, *Myotis sodalis*. Their hope is to discover where female Indianas set up maternity roosts and what role abandoned barns and small bridges play in their feeding and reproductive lives.

The team's mission is to add to the small body of knowledge about the bat's summer habitat. Tonight's adventure will tell whether this barn is a maternity roost or simply a handy spot to nap between meals.

The Indiana bat is Iowa's only federally and state-endangered mammal. Named for the state of its discovery, its population has plummeted, down by about 430,000 individuals, nearly 50 percent, since placed on the U.S. Endangered Species List in 1967.

BY 6:30 P.M., the crew has been at work for half an hour. Benedict has four students—Jessica Adey, Liz DePenning, Adena Schnedler and Dan Applegate—outside assembling poles into two 30-foot lengths, attaching tarps and pulleys to the poles. This assemblage will cover an enormous hole where the haymow used to open.

"Walk the ropes out," Benedict calls. "We'll just attach the tarps to that pulley line."

It is obvious he is a teacher, skilled at giving clear instructions with enough details that they know why they

are doing it. Every once in a while, he interjects some humor, keeping the team members' spirits up.

"The smell of cows is OK in moderation," he alludes to the smell of manure emanating from the barn.

The team is relaxed, but aware that the bats will start flying as dusk rolls in. The air is hot and humid, without a breeze. Just standing is enough exertion to build a sheen of sweat on people's faces.

"The best weather for bats is the worst weather for us, as far as I'm concerned," Benedict tells the students. "Why?" It's a rhetorical question. One that he answers anyway, "Lots of insects."

Insects and tree frogs hum as the students work. It's Iowa's summer orchestra. Cows munch to the east and a bull bellows to the south. A catbird calls.

"Hear that?" Benedict asks. "That's a scolding call."

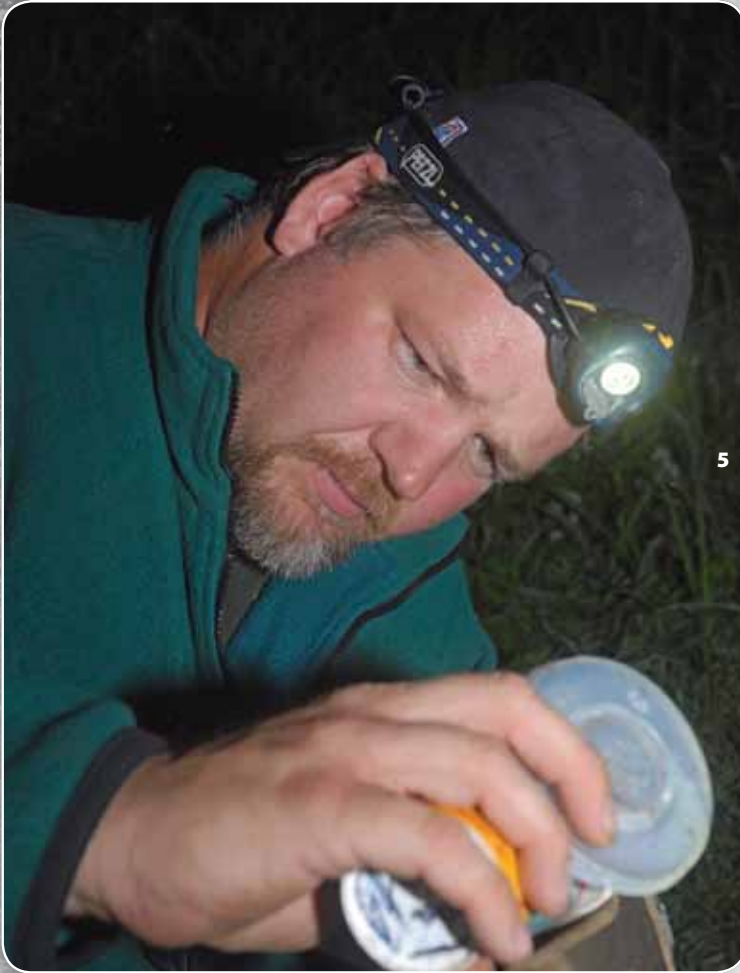
"Did you hear that? Whist da whist da whee-ee. That's a song sparrow."

The tarps and poles are joined and it takes five team members to hoist them.

While the others hoist, Howell places giant tarps over holes in the north end of the barn. As he finishes, he joins Russ' wife, Mary, and Russ' daughter, Sarah, as they put up harp traps on the south side of the building.

Resembling the instrument, harp traps are strung with monofilament lines 5 feet high, up and down in two offset rows. "The bats try to avoid the first line," Sarah Benedict





says. “Then they hit the line in the second row and fall into a bag underneath.” A senior at Central College, by age 20 she’s been catching bats for more than 10 years.

**IT’S 7:30 P.M.** and the two 30-foot poles are finally hovering above the barn roof—a sure target for lightning. Then, with thunder still rumbling off to the east, a cool wind springs up.

“Warn the people on the ropes,” exclaims Russ Benedict. “If they let go, we have to take the poles down to put the ropes back on.”

The wind displaces the tarps and the poles have to be readjusted. In the end, they go up and down three times, then are left down because of the wind, on hold until the last possible moment.

**IT’S 7:42** and a quiet sense of urgency fills the team. “We have an hour,” he says.

Mary Benedict finishes hanging mist nets over the holes on the bottom half of the barn. These nets are long horizontal pouches made of black, very fine netting. “Each net has five pockets, so the bats hit the net, then tumble down into one of the pockets,” she explains. “It’s important to get the ropes right, because each pocket goes in sequence.”

The pole team moves inside the barn where the cow pie aroma is stronger. There’s just enough light to see and avoid pools of liquid cow manure. Applegate climbs a ladder with tarps in hand and ties them over small holes

on the barn’s upper west side.

Sarah Benedict and Howell have already hung mist nets on the bottom half.

Applegate and Sarah Benedict are the two students with the most experience. A senior at Central College, Applegate has taken Russ Benedict’s tropical ecology classes, netting bats in three different rain forests in Belize and Costa Rica.

Russ Benedict calls, “I need two cup and lid people.”

Schnedler, a high school senior from Bentonport, and DePenning, a freshman at Iowa State University, volunteer. Their job will be recording data about each captured bat directly onto a McDonald’s soda cup, the temporary holding pen for the bat.

It’s late. Time to raise the tarps and poles for the final time. Almost as soon as they are up, a gust of wind threatens to blow them down. **FINALLY AT 8:27 P.M.**, Russ

1) The bat netting team assembles on a hot July night. 2) Bob Clevenstine, U.S. Fish and Wildlife Service, delights in the capture of a bat. 3) The team works to cover the many holes in the upper half of the barn. The biggest challenge is the giant hole near the haymow. They will raise four tarps on 30-foot poles to cover this gaping hole. 4) Most insect-eating bats catch bugs in their mouths. But they may use a membrane between their hind feet, the uropatagia, as a catcher’s mitt to reposition the bug in their mouth. As they bring the membrane forward, they perform quick aerial acrobatics, almost doing a backwards somersault. 5) Benedict begins to remove and examine a captive. 6) Bats are marked with green dye so data on recaptures is not processed twice. 7) Sarah Benedict releases one of the brown bats.



Another barn, another night. Stars blur as researcher Russ Benedict tracks a released Indiana bat. Next time you step outside at night in a mosquito-free area, thank a bat. Most North American bats are voracious foragers whose evening forays take their toll on mosquitoes, moths and other night-flying insects. The ultimate organic pesticide, a small bat eats from 1,000 to 2,000 mosquito-sized insects per night. All of Iowa's nine bat species eat insects.





Benedict climbs a ladder to anchor the tarps, tying ropes to whatever board or roof corner he can reach.

In two and one-half hours, the team has put up two harp traps, four mist nets, seven tarps, plus one giant tarp on 30-ft. poles.

In the lull before dusk, Benedict explains that big brown and little brown bats roosting in the barn will begin to fly out. Normally it will take them about 20 minutes to empty the barn. "They'll be zooming around soon," he says. But because we are here and the nets and tarps will baffle them, it will take about an hour.


The expected catch ratio is 100 to 200 big and little brown bats to one Indiana. Tonight's catch will tell if the Indianas are using the barn as a maternity roost, as they use a church in Pennsylvania and a barn near Burlington, Iowa. If the Indiana bats fly into the barn about 55 minutes after dusk, it will indicate that they are using

8:50 P.M. and the first bat is caught in the harp nets on the south. It's almost dark outside and it's definitely dark inside the barn. Team members look for bat silhouettes against a starlit sky.

"Dr. B," Applegate calls, "they're going out that hole at the top on the right." The team scrambles to pull the big tarp a little to the right and plug the hole.

9:03 P.M. Howell explains that bats can detect something as fine as a hair with echolocation, by sending out high-pitched squeals, usually out of range for the human ear. The sound waves strike the prey, or in this case, the netting, and return as echoes.

"The bat's ability to locate prey makes a Patriot missile system look like throwing rocks at something," Howell said. Its skill at processing sound waves is so refined, a bat can fly in one direction, locate a flying insect the size of a mosquito, compensate for the insect's dodging



*"The bat's ability to locate prey makes a Patriot missile system look like throwing rocks at something"*

trees, not structures, for their maternity roosts.

The team gathers inside the barn and reminisces about other trapping expeditions. Mary Benedict, who uses vacation time to trap, says, "We netted one year in a dry rainforest and caught 11 leaf-nosed bats in the first night. The second night, we caught 30 to 40 in one-half hour. We found their watering hole.

"We caught five to six wrinkle-nosed bats," she added. "They are just solid wrinkles, and bulging eyes, no hair on their face. Looks like a car accident. It is just hideous.

"Then there is the pygmy bat, so tiny."

Mary talks about how Russ became hooked on batting. "He had a professor at the University of Nebraska at Omaha who took him netting once. Three of that professor's students went on to graduate studies in bats."

Russ' daughter Sarah pipes up, "I'm hooked. The more we see, the more I want to learn. Especially about what they do during the summer. They switch roosts."

Russ pipes in, in this barn "last year, we had 161 bats. At one point, we took some of the nets down, because we just had too many to process. This is a really nice maternity colony" for little brown bats.

Schnedler learned about the trapping when she registered for college. "Russ told me that they'd be catching bats near my home in Bensonsport this summer and to come along for the experience. I said, 'Are you crazy?'" But here she is.

She admits to some mild apprehension about being able to handle bats batting around her head in a barn. She's about to find out.

movements as it darts through the night air and intercept the insect at a precise spot.

Calling it the ability to see with sound, Howell said echolocation enables the bats to avoid the fine netting. "But we are hoping they will quit using echolocation and just go by memory," he says.

9:06 P.M. "Harps," cries one of the team members. "Two of them. Might be Indianas."

Moving in near total darkness, with headlamps on only when necessary, the team is extremely busy. There is no time for notions of bats flying around their heads or cow dung smells. Although later in the evening, DePenning will regret that she wore her favorite tennis shoes for the trapping.

BY 9:24, they've got 15 bats, including a little brown with bleeding gums and mouth that Sarah Benedict tenderly removes from the mist nets. "That happens when they are chewing on the nets," she says. "OK, baby."

BY 9:32, 25 are captured. Team members are busy, gently extracting fragile bats from nets, tucking them into cups and labeling the time and location of the catch then placing the cups upside down on a piece of plywood.

The cups tip and tremble as the captives try to escape. Faint, scrabbling sounds fill the night air.

The bats are tiny. Little browns are about three inches long and fit easily into a cupped hand.

Schnedler says, "This is different than I thought it would be. This is fun."

Applegate notes that he's been trapping bats for the last three weeks on every suitable night.

The barn is busy until NEARLY 10:45 P.M. when the team





runs out of cups and Russ begins to process bats.

He randomly picks up a cup, one of 70 or more, each holding a bat. He carefully lifts a bat from its waxed paper cage and focuses his headlamp on the tiny mammal. Justifiably outraged and scared, the bat bares its miniscule teeth.

Benedict reads the scribbled information on the cup. "9:06 ... Harp."

Then he identifies the bat and its sex it, "ML ... Female...Adult...Non ... 41," he finishes as he examines the mammary glands and measures the forearm.

Translated, this means it was an adult female *Myotis lucifugus* (ML), or little brown, caught in the harp traps at 9:06. She was non-reproducing and had a forearm length of 41 millimeters.

His voice is loud, calm, regular—ticking off the data like a metronome, anchoring the trappers in the moment, overshadowing all the skittering and rustling noises and the hushed conversations. Schnedler and DePenning record the data and hand him another bat-filled cup.

Then, "8:50 ..NE," he reads.

"That was the first one we caught," says Applegate.

As each bat's vitals are recorded, it's dusted with an iridescent green dye, then released to fly away. A few are recaptured.

BY 11:00 P.M., catches are few. DePenning is still recording data, but swallows a big bug and chokes.

"Recording is a nasty job," says Mary Benedict. "The person with the light on gets the bugs."

"You'll have to buy surgical masks for your staff," kids Howell.

"Well this way, I don't have to feed them," Russ banters back.

In between catching bats, Sarah Benedict shares her considerable knowledge, "The big browns range up to five miles to forage. The little browns can go two to three miles. The Indiana ranges up to a mile."

Learning what they eat is mostly a matter of digging through scat, trying to determine the difference between moths and beetles from remnants of insect legs, shells, wings and feet. From prior studies, the Indiana eats moths, beetles, flies and midges.

Russ' voice rings out. "NLNM," meaning nipples large, no milk. Further translated, that means the female is done lactating, indicating her pup is feeding on something else or she's lost her young.

Then Benedict picks up a bat caught at 11:01 p.m. and identifies the first Indiana bat caught that night. "11:01. MS. Male." Instead of releasing the Indiana, he replaces it in the cup.

He tells students that telling the Indianas from the little browns is as simple as looking at their back feet. The little browns have larger, hairy back feet. The Indianas have pink lips, tiny feet with no hair and a glossy look to their fur.

Benedict is hopeful that more Indianas will be caught.





"Of the six caught in this barn last year, three or four were caught after 11," he says.

It is almost midnight and there are still 20 bats left to process. Yawns punctuate the low rumblings of conversation. The wind picks up and the tarp begins to scrape against the side of the barn. Only two lights punctuate the darkness: Russ' and the recorder's.

"I can't believe I'm sitting here in a barn with bats chirping away beside me and I am more worried about insects than the bats," exclaims Adey, taking turn as recorder.

Finally, it's time to process the three captured Indianas. Each will take about 45 minutes. The lactating female is first, so she can return to her pup. Howell picks a radio transmitter with frequency 316 from a box. He checks the transmitter to ensure it works.

Russ gently shaves the bat's back, using an electric razor to remove fur between her scapula, or shoulder bones. He places a small dab of surgical glue on the bare spot and lets it dry for five minutes. Then he glues on the transmitter, about one-half inch long by one-fourth inch wide. The attached wire antennae, about 6 inches long, sticks out behind the bat. She goes back in the cup so the glue can dry for 30 minutes.

The surgical glue will self-destruct within a week, allowing the transmitter to drop off and the female to fly freely. It will stay long enough for the team to track her

movements between day and night roosts.

The professionals, Benedict and Howell, continue to place transmitters on the Indianas. The second transmitter doesn't work, delaying the tagging. About 12:45 a.m., the first Indiana is released. Howell checks the radio receiver to make sure she's flying. She is. The signal shows she's zigzagging and flying up and down.

At 2 a.m. the team begins to roll up the nets and tarps. They come down much faster than they went up. By 2:30 a.m., the last Indiana bat is free and away.

One night's work. Eight hours. Eight team members. Two nets. Two traps. 142 bats caught. 10 big browns and 129 little browns. Only three Indianas caught and fitted with transmitters. Two males and one lactating female.

The team wearily stores the gear and discusses lodging for the remainder of the night, with breakfast by 9:30 a.m. so they can begin radio tracking the bats later that morning.

1) It's difficult to remove bats from mist nets as fine netting wraps tighter the longer they struggle. 2) Bats that hit harp traps normally drop into a pouch below, making extraction easier. 3) Russ Benedict shaves an Indiana's back, prepping for the transmitter attachment. 4) A tiny transmitter is held in place with surgical glue that self-destructs within a week to drop the transmitter and free the bat. 5) Each captured bat is marked with iridescent green dust so trappers can tell which bats were previously captured. 6) Captured bats are easily contained in paper soft drink cups. 7) An Indiana bat, complete with radio transmitter and antenna, is nearly ready for its return to the wild. 8) After hours of trapping, Howell tests equipment to ensure the next few days of sleep-deprived tracking will succeed.



Morning comes too early and it's with yawns that the trappers turn trackers and greet the day. It's an all-day process for the team to track the radio-tagged bats to their daytime roosts. After getting a fix on the bat, the team must identify the landowners and find them to ask permission to cross their land. Then it's a matter of trudging three-fourths of a mile through the woods, climbing up and down hills and across streams as tired people seek the bat's roost.

The team successfully tracks only one of the three Indiana bats caught on July 16 to a day roost. One is tracked for a day, but lost. The other is never found, despite the U.S. Fish and Wildlife Service mounting an air

search to see if it flew beyond its normal daytime range.

The one bat they follow is an adult male that uses the same day roost, a live shagbark hickory tree, for each of the four days it was tracked. As the team waits for dusk to fall, 11 bats leave the tree the first night, with seven bats leaving the tree on each of the next two nights.

However, other nights lead to other successes. From July 5 to 30, the team traps bats on six nights, catching and radio tagging 12 Indiana bats in two barns, under two bridges and twice in forested areas. Ten of the bats are tracked to day roosts in trees where the team sees between one and 34 bats exit their woody home at dusk.

### HIDING OUT IN HIBERNACULA

Restoring the Indiana bat hinges on protecting its winter homes, or hibernacula, from human disturbance.

While many mammals sleep through the winter, bats are among the few who actually hibernate. If you could observe one of the 300-plus Indiana bats packed closely together into a mere square foot of cave ceiling, you would see it is barely breathing. Its body would be cold to the touch, less than a degree different from the cave's temperature of 39 to 46 degrees Fahrenheit. Its heart would beat about 25 times per minute, compared to about 400 beats during normal activity.

Hibernation is a survival mechanism for this tiny mammal. Unable to store pounds of fat or migrate long distances, the bat survives winter by traveling to cold caves where its metabolism is depressed. There it gradually consumes its fat reserves, occasionally waking to drink, urinate or change places as temperatures fluctuate in the cave.

All hibernating bats are vulnerable as they hang, unaware, from cave ceilings. But, Indiana bats have such specific habitat requirements, that 85 percent of the population clusters together in a mere seven caves in the nation. Each major hibernacula may contain up to 125,000 bats. A disturbance in one cave can wipe out a large portion of the population.


The most suitable caves are in Indiana, Kentucky and Missouri, with less than 1 percent of the caves having sizeable colonies. Unfortunately, the caves preferred by the bats are also preferred as tourist attractions. Adding gates and entrances to commercialize the caves can alter the airflow or temperature regime so much that the Indiana bats must go elsewhere, or starve.

From October to March, any disturbance—whether from

temperature changes, spelunkers or vandals—can wake the bats, causing their metabolic rate to climb, using up their fat stores quickly and subjecting them to starvation.

Conservation efforts aimed at restoring pre-settlement airflows to caves and protecting known hibernacula from vandals have been somewhat successful. But the bats continue to decline and scientists are now striving to learn more about their summer habitats.





The night roosts indicate the Indianas are using the bridges and barns primarily for resting during a long night of foraging. Tummies full of insects, they stop and rest to digest, then take off again to forage for more.

That is a positive indication that despite loss of forested areas near large rivers, the bats are still finding adequate habitat under plates of loose bark on dead trees or occasionally using live trees like shagbark hickory. For now, at least, the Indiana bat can still find summer roosts where up to 100 females gather and raise their young.

It's a different story for big and little browns which use Iowa's aging barns for maternity roosts. Hidden between

the roofing materials, they select the hottest spots they can find to raise their young, sleeping out the day.

If you own such a building, consider leaving it up for bat habitat. It may be serving as a much needed home for our night marauders. If you must tear it down, check with the Iowa DNR to find out when the bats will leave their summer homes for winter habitat. Scheduling the demolition activities for fall, winter or early spring could save homes and lives.

If you are lucky enough to own forested land, think twice before you cut down a dead or dying tree. That decaying giant may be providing life for Iowa's endangered Indiana bat. 🦇

#### REPRODUCTIVE LIFE CYCLE OF THE INDIANA BAT

Like many bats in the Midwest, the Indiana Bat dances the mating dance in the fall just before hibernating. Unlike other mammals, though, the sperm lays dormant in the female's reproductive system throughout the winter months.

When she emerges from a cave in spring, ovulation occurs and the fertilized egg begins to grow as the female migrates to her summer roosts. From 50 to 100 pregnant females will congregate in a hollow tree or under the sheltering bark of a dead or dying tree.

About 50 to 60 days after fertilization occurs, the female gives birth to a single pup. During the day, the female and pup shelter under the tree bark, soaking up the heat on the sunny side of the tree. At nightfall, the mother leaves the colony to hunt.

Her wings are slim and tapered, unsuitable for long flights, but designed to provide the utmost mobility as she darts in and out among the tree tops, nabbing her dinner—over and over again. She will rest in a variety of night roosts after feeding voraciously.

Fed on mother's milk, pups grow rapidly and are ready to fly within three to five weeks. Soon, they, too, are making night foraging trips.

By early fall, the female and pup have put on fat layers, their winter food supply. Before frost, they will migrate up to several hundred miles to overwinter in a cave. As they cluster around their winter homes, males and females breed before hibernating.

The Indiana bat lives about 10 years and may not breed until she is two or three, making six or seven offspring her limit.